

## Wide temperature range

MTC-140 A -17 to 140°C / -1 to 284°F  
MTC-320 A 33 to 320°C / 91 to 608°F  
MTC-650 A 33 to 650°C / 91 to 1202°F

## Fast calibration is timesaving

The specially designed heating block profile heats up to 320°C / 608°F in just 4 minutes and to 650°C / 1202°F in only 10 minutes

## High flexibility

Not limitations by fixed holes. Interchangeable insertion tubes are used to match the diameter of the sensor-under-test

## Enhanced stability

MVI circuitry ensures stability despite mains supply variations in the engine room environment

## Timesaving features

Fast one-key-one-function access to the automatic switch test and auto-stepping

## Documentation made easy

RS232 communication interface and JOFRACAL calibration software package are part of the standard delivery

## DNV approval

All JF Instruments calibrators are marine type approved by Det Norske Veritas

## Complete marine program

Part of a complete program of marine approved temperature, pressure and signal calibrators; including temperature sensors  
See more at [www.jofra.com](http://www.jofra.com)

# JF Instruments MTC series Marine Temperature Calibrator

## PRODUCT DESCRIPTION

The MTC series of portable temperature calibrators from JF Instruments facilitates correct readings on all of your temperature monitoring devices. The MTC dry-block design does not use any hazardous hot liquid and heats up and cools down much faster than traditional ways of calibrating temperature sensors on a vessel. You can reach 320°C (608°F) in just 4 minutes and do it safely.



## Maintain and calibrate monitoring devices for:

- Turbo-charger lubrication • Lubricating oil systems • Cylinder / piston / fuel valve cooling media • Fuel oil inlet • Scavenge air • Exhaust gas • Sea water cooling • Thrust / shaft plane / stern tube bearings • Crankcase protection • Charge air • Turbine and gear bearings • Uptake gas • Steam • Feed water • Servo oil propeller pitch • Cooling water outlet • Purifiers • Refrigeration systems • Starting air • Gland steam • Hydraulic systems • Condensing system • Oil burner • Main steam • Generators • Condensers • Safety valves

The MTC series features a large backlit display that is easy to read even in well-lit areas. Units feature an informative display that provides icons and information regarding the status of the MTC and the calibration in-progress. The MTC series also features an auto-step function. Using this function you may stay in the control room or on the bridge and monitor the temperature reading while the calibrator, located in the engine room by the sensor, automatically steps through a number of pre-programmed temperatures.



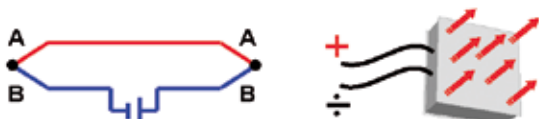
### Fast heating and cooling

The MTC-320 A and the MTC-650 A contain an innovative heating block profile. This design heats up the MTC-320 A to maximum temperature in just 4 minutes and the MTC-650 A in only 10 minutes. The fast performance of the heating block is due to the special profile that minimizes mass and yet, still accepts an insertion tube with a 1 in (26 mm) outer diameter. This design is a balanced compromise between temperature stability, homogeneity, and rapid heating and cooling.



### MTC-140 A heating/cooling block

The model MTC-140 A features Peltier elements. In 1834, Jean Peltier, a French physicist found that an "opposite thermocouple effect" could be observed when an electric current was connected to a thermocouple. Heat would be absorbed at one of the junctions and discharged at the other junction. This effect is called the "PELTIER EFFECT".

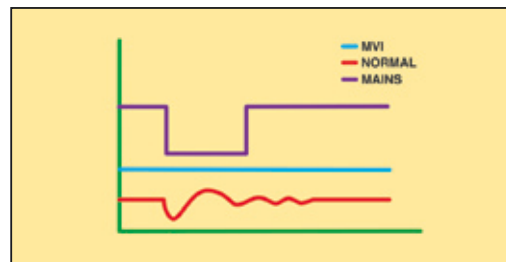


The practical Peltier element (electronic heating pump) consists of many elements of semiconductor material that are connected electrically in series and thermally in parallel. These thermoelectric elements and their electrical interconnections are mounted between two ceramic plates. The plates serve to mechanically hold the overall structure together and to electrically insulate the individual elements from one another.

### MVI - Improved temperature stability

MVI stands for "Mains power Variance Immunity".

Unstable mains power supplies are a major contributor to on-site calibration inaccuracies. Traditional temperature calibrators often become unstable in shipboard environments where large electrical motors, heating elements, and other devices are periodically cycled on and off. The cycling of supply power can cause the temperature regulator to perform inconsistently leading to both inaccurate readings and un-stable temperatures.



The MTC series calibrators MTC-320 A and MTC-650 A employ the MVI, thus avoiding such stability problems. The MVI circuitry continuously monitors the supply voltage and ensures a constant energy flow to the heating elements.

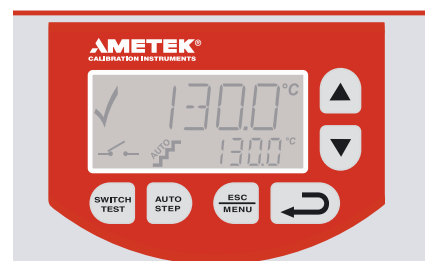
The MTC-140 A does not require the MVI circuitry because the Peltier elements are energized with a stabilized DC voltage.

### Easy-to-use, intuitive operation

All instrument controls may be performed from the front panel. The heat source is positioned away from the panel. This design helps to protect the operator.

The main functions on the MTC series are designed with one-key-one-function logic. This means that there are no sub-menus or difficult to remember multiple keystrokes necessary to access primary functions.

The easy-to-read, backlit display features dedicated icons, which help in identifying instrument conditions and operational steps.



### Set temperature

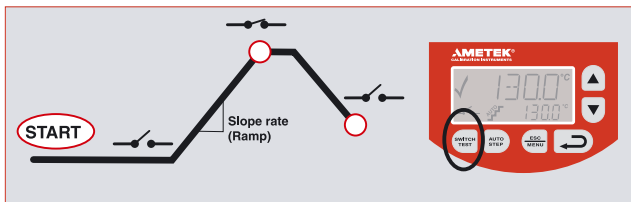
The "Up" and "Down" arrow keys allow the user to set the exact temperature desired with a resolution of 0.1°C or °F.

### Instrument setups

The MTC series stores the complete instrument setup, including: engineering units, stability criteria, resolution, display contrast, slope (ramp) rate, auto-step settings, and maximum temperature.

### Stability indicator

The bold checkmark (✓) on the display indicates that the calibrator has reached the desired set temperature and is stable. The operator may change the stability criteria and establish a greater sense of security in the calibration results. A convenient countdown timer is activated five minutes before the unit reaches stability.



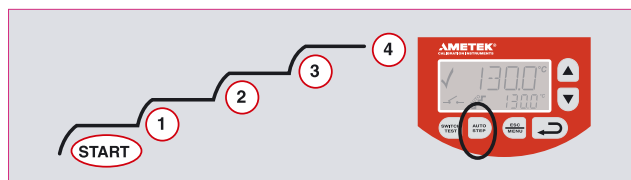
### Automatic switch test

Operators can save a lot of time using the automatic thermostat test function to find values for the "Open" and "Close" temperatures. Additionally, this feature displays the hysteresis (deadband) between the two points. The feature ensures a very high repeatability when testing thermo-switches. Simply press the SWITCH TEST key to activate the function.

### Auto-stepping

This feature saves manpower. The operator may stay in the control room, or on the bridge, monitoring the output from the sensor-under-test while the MTC series calibrator is placed in the engine room and automatically changes the temperature using a programmed step value and rate. Up to 9 different temperature steps may be programmed, including the hold time for each step.

This feature is also ideal for burning-in new sensors prior to installation; this minimizes initial drift and allows for initial testing.



### Maximum temperature

From the setup menu, the user can select the maximum temperature limit for the calibrator. This function prevents damage to the sensor-under-test caused by the application of excessive temperatures. The feature also aids in reducing drift resulting from extended periods of exposures to high temperatures. This feature can be locked with an access code.

### Re-calibration/adjustments

The MTC series has a very easy and straightforward procedure for re-calibration/adjustment. There is no need for a screwdriver or PC software. The only thing you need is a reliable reference thermometer.

Place the probe in the calibrator and follow the instructions on the display. Third-party labs and calibration facilities will be able to perform this function if a certificate from an independent source is necessary. Of course, AMETEK can provide you with a traceable calibration certificate from our labs when you require a higher level of confidence.

### JOFRACAL CALIBRATION SOFTWARE

JOFRACAL calibration software ensures easy calibration of RTD's, thermocouples, transmitters, thermoswitches, pressure gauges and pressure switches.

JOFRACAL can be used with JOFRA DPC-500, APC, CPC and IPI pressure calibrators, all JOFRA temperature calibrators, as well as JOFRA AMC900, ASC300 multi signal calibrator and ASM-800 signal multi scanner. When used with JOFRA ASM-800 signal multi scanner, JOFRACAL can perform a simultaneous semi automatic calibration on up to 24 pressure and/or temperature devices under test in any combination.

JOFRACAL software controls the complete calibration procedure, stores the results and provides a calibration audit trail through hard-copy certificates. All calibration data are stored for each sensor to monitor drift and optimise recalibration intervals. A scheduler feature allows planning of future calibrations.

Please find more information about JOFRACAL calibration software in specification sheet SS-CP-2510, which may be found at [www.jofra.com](http://www.jofra.com)





## FUNCTIONAL SPECIFICATIONS

### Mains specifications

Voltage MTC-140/320/650 A 115V(90-127) / 230V(180-254)  
Frequency, non US deliveries ..... 50 Hz  $\pm 5$ , 60 Hz  $\pm 5$   
Frequency, US deliveries ..... 60 Hz  $\pm 5$   
Power consumption (max.) MTC-140 A ..... 150 VA  
Power consumption (max.) MTC-320 A / 650 A ..... 1150 VA

### Temperature range

MTC-140 A  
Maximum ..... 140°C / 284°F  
Minimum @ ambient temp. 0°C / 32°F ..... -30°C / -22°F  
Minimum @ ambient temp. 23°C / 73°F ..... -17°C / -1°F  
Minimum @ ambient temp. 40°C / 104°F ..... -2°C / 28°F  
MTC-320 A ..... 33 to 320°C / 91 to 608°F  
MTC-650 A ..... 33 to 650°C / 91 to 1202°F

### Resolution (user-selectable)

Selectable .....  
1° or 0.1°C/°F

### Stability

MTC-140 A .....  $\pm 0.05^\circ\text{C}$  /  $\pm 0.09^\circ\text{F}$   
MTC-320 A / 650 A .....  $\pm 0.1^\circ\text{C}$  /  $\pm 0.18^\circ\text{F}$

Measured after the stability indicator has been on for 10 minutes.  
Measuring time is 30 minutes.

### Time to stability (approximate)

MTC-140 A ..... 5 min.  
MTC-320 A / 650 A ..... 8 min.

### Accuracy

MTC-140 A .....  $\pm 0.4^\circ\text{C}$  /  $\pm 0.7^\circ\text{F}$   
MTC-320 A .....  $\pm 0.5^\circ\text{C}$  /  $\pm 0.9^\circ\text{F}$   
MTC-650 A .....  $\pm 0.9^\circ\text{C}$  /  $\pm 1.6^\circ\text{F}$

Specification when using the internal reference. (Load 4 mm OD reference probe in the center of the insert).

### Immersion depth

MTC-140 A (insulation included) ..... 115 mm / 4.5 in  
MTC-320 A / 650 A ..... 110 mm / 4.3 in

### Heating time

MTC-140 A ..... -17 to 23°C / 1 to 73°F ..... 3 minutes  
MTC-140 A ..... 23 to 140°C / 73 to 284°F ..... 15 minutes  
MTC-320 A ..... 33 to 320°C / 91 to 608°F ..... 4 minutes  
MTC-650 A ..... 33 to 650°C / 91 to 1202°F ..... 10 minutes

### Cooling time

MTC-140 A ..... 100 to 0°C / 212 to 32°F ..... 10 minutes  
MTC-140 A ..... 0 to -15°C / 32 to 5°F ..... 13 minutes  
MTC-140 A ..... 140 to 100°C / 284 to 212°F ..... 2 minutes  
MTC-320 A ..... 320 to 100°C / 608 to 212°F ..... 16 minutes  
MTC-650 A ..... 650 to 100°C / 1202 to 212°F ..... 28 minutes

### Switch input (dry contact)

Test voltage ..... Maximum 5 VDC  
Test current ..... Maximum 2.5 mA

### Engine rooms - testing the temperature in exhaust gas

#### Savings

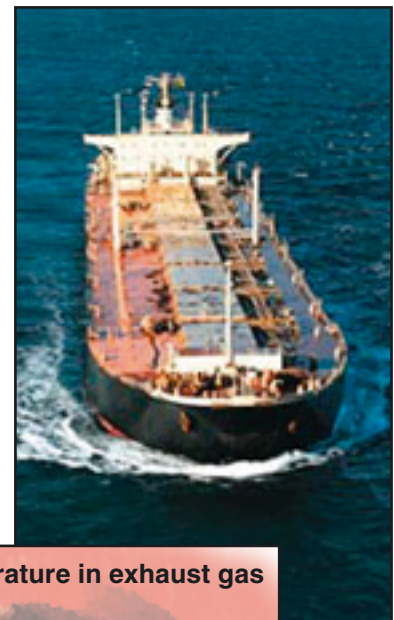
The exhaust gas temperature is a very important factor. If the temperature is too low, too little fuel is let into the cylinder, and if the temperature is too high, too much fuel is let into the cylinder.

Often a range of  $\pm 10^\circ\text{C}$  ( $50^\circ\text{F}$ ) is allowed, before an alarm is activated. However, if calibration is performed more often, this range could be reduced and a more economical combustion could be achieved.

### Engine rooms - testing the temperature in exhaust gas

#### Application

On each cylinder, a thermometer has been placed close to the exhaust gas outlet to measure the temperature of the exhaust gas. This thermometer breaks very often due to the impact from the exhaust gas. As a consequence the temperature indication is often inaccurate. The thermometers most frequently have a scale from 350 to 450°C (662 to 842°F).



## KEY FEATURES

### Automatic switch test

Finds switching temp. .... Open, close, hysteresis  
Slope rate, programable ..... 0.1 to 9.9 °C/°F

## Auto stepping

Programmable.....	Up to 9 steps
Dwell time on each step .....	Programmable

### Enhanced stability

Unstable mains protection .....	MVI Circuitry
Stability indication .....	Yes, in display

## Multi-information display

Stability indicator.....	Bold checkmark
Countdown timer before stable .....	4 minutes
Temperature .....	SET and READ simultaneously
Alphanumeric messages.....	Yes
Calibration status icons .....	Yes

### Training mode (heating/cooling block disabled)

Simulation of all functions ..... Yes  
 Simulating heating and cooling ..... Approx. 100° per minute

## Service facilities

Adjustment of the unit from the keypad .....	Yes
Self explanatory guide in display .....	Yes

Other information: Displays serial number, software revision level, and last calibration date

## Setup facilities

Stability criteria.....	Extra time before "stable indication" is shown
Display resolution.....	0.1° or 1°C/°F
Temperature units .....	°C and °F
Slope rate .....	0.1 to 9.9°/minute
Maximum temperature .....	Any value within range

## Type approval certificate

All JF Instruments calibrators are type approved by Det Norske Veritas. Find the certificate at our web-page [www.jofra.com](http://www.jofra.com)

DNV Marine Approval, Certificate no.:.....A-10549

## PHYSICAL SPECIFICATIONS

## Instrument dimensions

L x W x H:.....241 x 139 x 325 mm / 9.5 x 5.5 x 12.8 in

### Instrument weight

MTC-140 A .....	6.5 kg / 14.3 lb
MTC-320 A .....	5 kg / 11 lb
MTC-650 A .....	6.4 kg / 14.1 lb

### Insert dimensions

MTC-140 A  
Diameter x length..... 19 mm x 100 mm / 0.75 x 3.9 in

MTC-320 A, MTC-650 A  
Diameter x length..... 26 mm x 120 mm / 1 x 4.7 in

**Weight of non-drilled insert (approximate)**

MTC-140 A .....	2.6 oz / 75 g
MTC-320 A .....	5.8 oz / 170 g
MTC-650 A .....	17.8 oz / 510 g

**Shipping (with std. accessories + carrying case)**

Weight: MTC-140 A ..... 12.5 kg / 27.6 lb  
Weight: MTC-320 A ..... 11 kg / 24 lb  
Weight: MTC-650 A ..... 12 kg / 27 lb  
Size: L x W x H ..... 507 x 232 x 415 mm / 19.9 x 9.1 x 16.3 in

**Shipping (with std. accessories but no carrying case)**

Weight: MTC-140 A ..... 10 kg / 22 lb  
Weight: MTC-320 A ..... 8 kg / 17.5 lb  
Weight: MTC-650 A ..... 9.5 kg / 21 lb  
Size: L x W x H ..... 465 x 255 x 470 mm / 16.4 x 9.8 x 14.6 in

## Shipping (carrying case only)

Weight: ..... 5.0 kg / 11 lb  
Size: L x W x H.... 507 x 232 x 415 mm / 19.9 x 9.1 x 16.3 in

## Miscellaneous

Serial data interface ..... RS232 (9-pin Male)  
Operating temperature ..... 0 to 40°C / 32 to 104°F  
Storage temperature ..... -20 to 50°C / -4 to 122°F  
Humidity ..... 0 to 90% RH  
Protection class ..... IP-10  
CE Conformity.....EN61326 : 1997/A1:1998 / corr. (2000)  
                              EN61010-1 : 1993/A2:1995



## STANDARD DELIVERY

- MTC dry-block calibrator (user specified)
- Mains power cable (user specified)
- Traceable certificate - temperature performance
- Insert (user specified)
- Tool for insertion tubes
- User manual
- Test cables (1 x red, 1 x black)
- 3 pcs. insulation plugs for:
- 1/4, 3/8, 1/2 in (6, 10, 13 mm) sensors (MTC-140 A only)
- RS232 cable
- JOFRACAL calibration software

## ACCESSORIES

- |         |  |
|---------|--|
| 122832  | Cleaning Brushes - 4 mm - Package of 3 pcs   |
| 60F174  | Cleaning Brushes - 6 mm - Package of 3 pcs   |
| 22822   | Cleaning Brushes - 8 mm - Package of 3 pcs   |
| 65-F100 | Insulation in Tube, 100 mm x Ø25 mm  |
| 65-F101 | Insulation in Tube, 150 mm x Ø25 mm  |
| 65-F102 | Insulation in Tube, 200 mm x Ø25 mm  |
| 65-F103 | Insulation in Tube, 250 mm x Ø25 mm  |
| 65-F104 | Insulation in Tube, 300 mm x Ø25 mm  |
| 65-F105 | Insulation in Tube, 350 mm x Ø25 mm  |
| 65-F106 | Insulation in Tube, 400 mm x Ø25 mm  |
| 65-F107 | Insulation in Tube, 450 mm x Ø25 mm  |
| 123469  | Set with 3 pcs of insulation plugs<br>* 6, 10 and 13 mm / 1/4, 3/8 and 1/2 in.<br>(MTC-140 only)             |
| 125068  | Support rod set for sensors, 2 grips, 2 fixtures<br>* Support rod set can be mounted on all JOFRA dry-blocks |
| 125066  | Extra fixture for sensor grib  |
| 125067  | Extra sensor grib  |
| 125002  | Edgeport Converter with 4 pcs of RS232 ports   |
| 123408  | Carrying Case for CTC/MTC A models   |
| 104216  | Thermal Protection Shield  |

## Marine approved temperature sensors

JF Instruments also has a series of temperature sensors which are type approved by classification societies for marine applications such as measuring exhaust gases, cooling water for diesel engines, and product or room temperatures in refrigeration stores. These sensors are specially designed with high endurance for vibration according to IEC 68-2-6. Approvals from Lloyds Register of Shipping and Det Norske Veritas. For further information please visit our web-page at [www.jofra.com](http://www.jofra.com)



## Inserts, heat shield, and cleaning brushes

Always use the original inserts where material and physical dimensions have been optimized. A drilling guide is included if you buy undrilled inserts.

Use the cleaning brushes to clean the bores in your inserts when necessary.



## Carrying case (Optional) - 123408

The protective carrying case ensures safe transportation and storage of the instrument and all associated equipment. The carrying case is included in the standard delivery.



## Thermal Protection Shield (Optional) - 104216

An external heat shield is available and may be placed on top of the calibrator to reduce the hot air stream around the sensor-under-test. This is especially important for testing thermocouples having head-mounted transmitters with cold-junction compensation.



## Support rod set for sensors (Optional) - 125068

It is possible to order a support rod for sensors, which can be mounted on the side of all JOFRA dry-block calibrators and holds the sensors under test in their position, while calibrating them.

The support rod set includes 2 pieces of sensors grips and 2 pieces of fixtures for sensor grips.



125066 Extra fixture for sensor grib

125067 Extra sensor grib

## PREDRILLED INSERTS FOR MTC SERIES

Inserts for MTC-140 A and MTC-320 A are made of aluminium. Inserts for MTC-650 A are made of brass.

All specifications on hole sizes refer to the outer diameter of the sensor-under-test.

The correct clearance size is applied in all predrilled inserts.

Spare part no. for predrilled inserts - metric (mm)				
		Instruments		
Probe diameter	Insert code <sup>1</sup>	MTC-140 A <sup>2</sup>	MTC-320 A	MTC-650 A
3 mm	003	123428	123436	123444
4 mm	004	60F451	100177	100196
5 mm	005	123429	123437	123445
6 mm	006	60F453	100179	100198
7 mm	007	123430	123438	122516
8 mm	008	105185	100182	100201
9 mm	009	105186	100183	100202
10 mm	010	105187	100185	105188
11 mm	011	123431	100188	100204
12 mm	012	123432	100186	100206
13 mm	013	123433	60F339	105189
14 mm	014	N/A	100190	100208
15 mm	015	N/A	100191	100209
16 mm	016	N/A	123439	123446
18 mm	018	N/A	123440	122517
20 mm	020	N/A	123441	122518
Package of the above inserts		124679	124681	124685
Multi-hole type 1	M01	123479 <sup>2</sup>	123475	123476

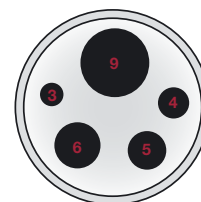
Spare part no. for predrilled inserts - imperial (inch)				
		Instruments		
Probe diameter	Insert code <sup>1</sup>	MTC-140 A <sup>2</sup>	MTC-320 A	MTC-650 A
1/8 in	125	60F450	100176	100195
3/16 in	187	60F452	100178	100197
1/4 in	250	60F454	100180	100199
5/16 in	312	60F456	100181	100200
3/8 in	375	60F458	100184	100203
7/16 in	437	60F460	100187	100205
1/2 in	500	60F462	100189	100207
9/16 in	562	60F464	60F344	60F408
5/8 in	625	60F466	100192	100210
11/16 in	688	N/A	60F348	60F412
3/4 in	750	N/A	100193	100211
3/16 in	813	N/A	60F352	60F416
7/8 in	875	N/A	60F354	60F418
Package of the above inserts		124680	124682	124686
Multi-hole type 2	M02	123480 <sup>3</sup>	123477	123478



Multi-hole M01  
(MTC-140 A)



Multi-hole M02  
(MTC-140 A)



Multi-hole M01  
(MTC-320 / 650 A)



Multi-hole M02  
(MTC-320 / 650 A)

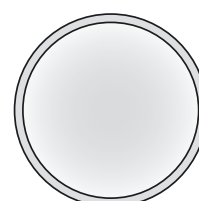
Note 1: Use the insert code, when ordered as the standard insert together with a new calibrator.

Note 2: MTC-140 A only: Remember to use matching insulation plugs.

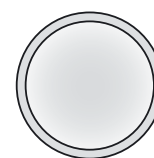
Note 3: MTC-140 A only: All multi-hole inserts are delivered with a matching insulation plug.

## UNDRILLED INSERTS FOR MTC SERIES

Inserts, undrilled			
	Instruments		
Inserts	MTC-140 A <sup>1</sup>	MTC-320 A	MTC-650 A
5-pack, undrilled inserts	60F448	100175	100194
Undrilled insulation plug	123937	N/A	N/A



(MTC-320 / 650 A)



(MTC-140 A)



## ORDERING INFORMATION

Order number		Description
		<b>Base model number</b>
MTC140A		MTC-140 A, -17 to 140°C (-1 to 284°F)
MTC320A		MTC-320 A, 50 to 320°C (122 to 608°F)
MTC650A		MTC-650 A, 50 to 650°C (122 to 1202°F)
		<b>Power supply (US deliveries 60 Hz only)</b>
115		115VAC
230		230VAC
		<b>Mains power cable type</b>
A		European, 230V,
B		USA/CANADA, 115V
C		UK, 240V
D		South Africa, 220V
E		Italy, 220V
F		Australia, 240V
G		Denmark, 230V
H		Switzerland, 220V
I		Israel, 230V
		<b>Insert type and size</b>
XXX		1x Insert for dry-block configuration (Please see insert section for correct code)
		<b>Calibration certificate</b>
F		NPL Traceable Calibration Certificate (standard for Europe, Asia, Australia and Africa)
G		NIST Traceable Temperature Certificate (standard for Americas)
H		DANAK Accredited Calibration Certificate (Optional)
		<b>Options</b>
C		Carrying case

**MTC650A230AM01FC** **Sample order number**  
 JOFRA MTC-650 A with standard accessories,  
 230VAC, European powercord, multi-hole type  
 M01, NPL traceable certificate and carrying  
 case.



**AMETEK Calibration Instruments**  
 is one of the world's leading manufacturers and  
 developers of calibration instruments for  
 temperature, pressure and process signals  
 as well as for temperature sensors both from  
 a commercial and a technological point of view.

**JOFRA Temperature Instruments**  
 Portable precision thermometers. Dry-block and  
 liquid bath calibrators: 4 series, with more than  
 25 models and temperature ranges from  
 -90° to 1205°C / -130° to 2200°F. All featuring speed,  
 portability, accuracy and advanced documenting  
 functions with JOFRACAL calibration software.

**JOFRA Pressure Instruments**  
 Convenient electronic systems ranging from  
 -1 to 1000 bar (25 inHg to 14,500 psi) -  
 multiple choices of pressure ranges, pumps and  
 accuracies, fully temperature-compensated  
 for problem-free and accurate field use.

**JOFRA Signal Instruments**  
 Process signal measurement and simulation for  
 easy control loop calibration and measurement  
 tasks - from handheld field instruments to  
 laboratory reference level bench top instruments.

**JOFRA / JF Marine Instruments**  
 A complete range of calibration equipment  
 for temperature, pressure and signal,  
 approved for marine use.

**FP Temperature Sensors**  
 A complete range of temperature sensors  
 for industrial and marine use.

**M&G Pressure Testers**  
 Pneumatic floating-ball or hydraulic piston dead  
 weight testers with accuracies to 0.015% of reading.

**M&G Pumps**  
 Pressure generators from small pneumatic  
 "bicycle" style pumps to hydraulic pumps  
 generating up to 1,000 bar (15,000 psi).

*...because calibration is  
 a matter of confidence*

**AMETEK®**  
 CALIBRATION INSTRUMENTS

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